Problem

The purpose of this project is to calculate the acceleration of a one moving object between two stationary point objects. To accurately calculate this acceleration the gravitational attraction of the two point objects must be taken into consideration. The change in the mass of the moving object and the behavior of time must also be adjusted by speed approaching the speed of light.

Summery

The development of the solution to this project was done with C++. This program has nine vital variables: velocity of the moving object, the force applied to that object, the acceleration of that object, time in relation to velocity, the mass of the moving object, in relation to velocity, the mass of consumable fuel on that object, the distances between the two point objects, and the masses of each of the two point objects. The initial values of these variables, with the exception of acceleration, must be input before the calculations begin. Each of these variables is altered in intervals, which are measured in seconds. Seconds are used as the measurement, because the second is the standard for acceleration. The values of the initial mass and mass with the consumed fuel subtracted, and then averaged. Following the adjustment of the mass the force applied to the moving object is then adjusted based on the gravitation force of the two point objects. Acceleration is then calculated useing the averages of the mass calculation. The acceleration over one second is then added to the velocity. This completes one iteration of the loop that controls all variables in the program. The altered values the variables are then returned as initial values to the beginning of the loop. The program runs until the destination object is reached, or if the moving object returns to the initial location as a result of the gravitational attraction of that point object.

The simplifying assumptions of this project relate to the effects of gravity, and the usage of Newtonian Mechanics, and Relativity. Two assumptions exist with regard to gravity. The first is that no gravitational force other than the two point objects has any effect on the moving object. The second is that under no circumstances will the mass of the moving object exert a gravitational force on either of the point objects. The assumption regarding Newtonian Mechanics verses Relativity is that all acceleration is based on Newtonian mechanics, and the effects of relativity only affect the mass and time related to the moving object.

Method

To develop a solution to this problem Newton Mechanics, and Relativity were used. The acceleration and the effects of gravity were based on Algorithms derived from Newtonian Mechanics. For acceleration the formula "A=F/M" was used. Where: A= acceleration (M/s^2), F= force(N), M= mass (Kg).

For the effects of gravity the formula F=G(M1*M2/d). Where: F= gravitational force(N), G= the gravitation constant =, M1= Equals the mass of the either of the point object involved in the calculation(Kg), M2 = The mass of the moving object (Kg), and d = The distance between m1 and m2 (m).

Relativity was used to calculate the change in mass and time with an increase in speed. The equation for the increase in mass is: m=m1/((1-v^2)/c^2)^(1/2). Where; m= The mass corrected for the speed, m1= The initial mass, v = The velocity of the moving object, and c = The speed of light

The equation for the change in time is: T= 1/(1-(v^2/c^2)^(1/2)). Where: T = The time corrected for speed, v = the velocity, c = The speed of light.

Results

Each set of results for tested calculations vary based upon the two points which are travelled between. The final calculation of any system occurs when the moving object reaches either of the two initialy difined point objects. The returned values for the and mass is retuned for both the adjusted mass for speed, and the rest mass with the mass of the consumed fuel subtracted. The final value of time is returned, while the value of time at rest is not as that it is equal to one. The final velocity, and acceleration, prior to reaching the final point are returned. The distances between the two point objects will not be returned; only a statement of which of the point objects was reached will be returned.

Conclusion

This program returns accurate values for the time, and fuel requirements for modern space travel due to the low mass of any craft that would be under the current technology, wiht respect to the stellar objects which they travel between. Inaccuracy will increase when velocities reach a magnitude near the speed of light, due to the increaseing mass of the moving object. In real circumstances as the mass of the moving object approached infinity, the two point objects would move closer to the moving object. In conclusion the results of this project hold a large degree of practical application in todays space technology.

Original Achievement

Out Achievement was to be able to calculate the time it would take for an object to travel from one point to other point, while accurately measuring fuel consumption.

Software, and References

The development software used to write the code for this problem was:

-Microsoft Visual Studio
-Borland C++

The references used in the development of algorithms for this program were:

-Einstein, Albert. Relativity. New York: Three Rivers Press, 1961.
-Feynman, Richard. Six Easy Pieces. Cambridge: Persius Books, 1995.
-Zitzewitz,Paul; Neff, Robert; Davids, Mark. Physics: Principles and Problems. New York: Glencone, 1992

Acknowledgments

We would like to thank Professor Daniel Finley of the University of New Mexico for the assistance he provided to us in developing the algorithms used for the relativity calculations.